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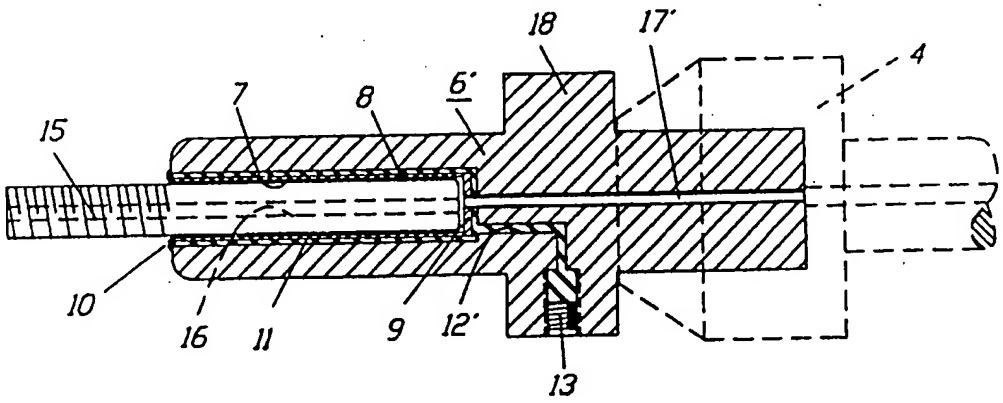

(57) Abstract

A tool extender for machining machines consisting of an extender body (6) arranged to, in a known manner, be fixed in for instance a chuck (4) in a tool machine and provided with a holding means for a tool (15) in the form of a sort of hydraulic gripping bushing with an internal thin, unslotted sleeve (8), which is very precisely centered and fixed, specially welded in an axial hole (7) on the end of the extender, in such a way that a thin gap is created between the hole (7) of the extender and the gripping sleeve (8), which gap is filled with a plastic or elastic pressure medium (11) being arranged to be pressurized and depressurized with a suitable means (13), whereby a tool (15) with adjusted dimension is fastened in and detached from the extender.

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Tool Extender for Machining Applications

At all sorts of machining applications, e.g. lathes, boring machines, grinding machines, milling cutters, etc., difficulties sometimes arise to reach surfaces or holes on different levels of the work-piece to be machined, because of the fact that the holder for the tool in the machine has too large an external diameter, or is too short.

This difficulty can for instance arise when one wishes to machine a lower angular section of the work-piece as illustrated in Fig. 1, or to drill a hole in the bottom surface of a hole of a larger diameter in the work-piece, or to machine a recessed part in any other way.

In these cases it is necessary to either form the tool, for instance the drill, the lathe tool, the milling cutter, etc., with some type of axial extension, or to use some kind of extender, usually an extender that is braced by the holding means of the machine and in which the tool is mounted, normally into a hole at the end of the extender.

Known extenders are of a mechanical construction and the tool is thus fastened in the extender by a screw joint, a wedge joint, a taper joint or similar, which joints usually do not bring about a particularly good holding accuracy. With mechanical extenders and holding means, smaller or larger runouts of the machining tool are practically unavoidable. Due to the fact that the cutting insert or the machining part of the tool, when using an extender, will be displaced relatively far away from the holding means of the machine, any occurring runouts will become very noticeable, which leads to the produced surfaces not

obtaining the desired smoothness. It may become necessary to use low machining speeds, which result in long machining times.

The mentioned problems are particularly noticeable when machining with tools comprising cutting inserts of cemented carbide. These tools require small radial runouts in order to work correctly and deliver optimal results.

The fastening into the holding means of the machine can usually be accomplished with relatively good precision, but contrary thereto, it can be difficult to obtain a high precision at the fastening of the tool in the extender, specially due to the fact that the holding means of the extender has to be formed with a diameter as small as possible. Therefore, the runouts that occur when using mechanical extenders genereally derive from the bracing means of the extender for the tool.

Therefore, the basis of the present invention resides in the problem of obtaining a tool extender for machines, which extender is so formed that the tool can be gripped with a considerably higher precision than achieved hitherto and which, when used in a machinining device, attains an absolute minimum of runouts at the machining part of the tool, or in many cases no runouts at all, so that one can hold high machining speeds and attain a very high smoothness of the machined surfaces, and which is also particularly suitable when machining with cutting inserts of cemented carbide.

According to the invention, the holding means for the tool in the extender is of hydraulic type and is formed as a sort of hydraulic clamping bushing with an internal, thin, unslotted sleeve, which is very accurately centered and fastened, for instance by

welding, in an axial hole at the end of the extender, so that a thin gap is provided between the inner hole of the extender and the holding sleeve, this gap being filled with a plastic or elastic pressure medium. For the pressurization of the pressure medium, some sort of pressurization means is provided. At pressurization, the holding sleeve is expanded and braces a tool introduced into the sleeve. The pressurization is effected absolutely uniformally around the unslotted sleeve and, therefore, the holding accuracy is very high. The pressurization medium also has a vibration damping effect, which makes the tool work under stable conditions. This is important for all tool materials and for cutting inserts of cemented carbide in particular.

The hydraulic extender can be construed according to two different principles, viz. I) so that the pressurization means is placed axially in the center of the braced part of the extender in the machine, or II) so that the pressurization means is arranged radially, outside the holding arrangement of the machine.

I) The first-mentioned principle brings the advantage that the external dimensions of the extender are minimized, that a very good accessability is attained at machining, and that the pressurization means are protected against the intrusion of chips, etc., during machining; the pressurization means are hidden within the holding means of the machine. However, when changing tools, the extender has to be detached from the holding means of the machine.

II) It is true that the second principle usually makes it necessary to form the extender with a somewhat larger diameter than the system according to

I), however it brings the advantage that the tool can be replaced in the extender without the latter having to be detached from the holding means of the machine, and it is easy to arrange cooling liquid conduits through the extender for further passage outwardly, through the tool. This is important in view of the fact that modern milling cutters, drills and threading taps, etc., often require cooling and, therefore, are equipped with axially extending cooling medium conduits through the tool, which conduits can be connected directly to the cooling medium conduits of the extender.

The invention will now be described in more detail in connection with the appended drawings, wherein:

Figure 1 shows a known arrangement and illustrates problems which can arise when machining with such an arrangement;

Figure 2 shows the use of a known type of mechanical extender in order to eliminate the problems illustrated in Figure 1;

Figure 3 shows an extender of a hydraulic type according to the invention;

Figure 4 illustrates the use of the extender of Figure 3;

Figure 5 shows an alternative type of extender according to the present invention with a hydraulic tool holding means with a radial pressurization mechanism;

Figure 6 shows a part of the extender according to Figure 5 in a larger scale; and

Figure 7 shows the extender according to Figure 5 when used in a tool machine.

Figure 1 illustrates the problem that can

arise when machining a lower surface 1 of a work-piece 2 with a tool 3, for instance a milling cutter, a drill, a threading tool, etc., which is fastened in a chucking fixture 4 of a non-shown tool machine. It is clear that the chuck will hit against an edge of the work-piece 2, which makes it impossible to lower the tool 3 to the work-piece surface 1.

In order to solve this problem, one has normally used a mechanical extender 5, as shown in Fig. 2. The lower or outer end of such an extender is provided with some sort of mechanical means for holding a tool, e.g. a conical hole, a wedge means, a screw means or similar, and the extender 5 with the tool 3 is gripped in a known manner by the chuck 4 in the tool machine.

As mentioned above, an extender 5 with such mechanical holding means for the tool 3 causes problems, with practically unavoidable radial runouts in the tool and these runouts obviously become larger the longer the extender is and the more distanced the operative cutting edge of the tool 3 is from the chuck 4.

According to the invention, it is therefore suggested to provide the extender with a holding means for the tool, which means results in an extraordinary high precision and a very firm fastening of the tool and which, moreover, has a vibration damping effect on the tool.

The extender shown in Fig. 3 consists of a extender body 6 with an axial hole 7 in its end, in which hole a thin sleeve 8 is mounted and extends to the bottom 9, or very near to bottom 9 of the axial hole 7. The sleeve is welded at 10 inside the extender hole 7. The sleeve 8 has axially and radially somewhat smaller dimensions than the extender hole 7 and the gap

between the extender hole 7 and the sleeve 8 is filled with a plastic or elastic pressure medium 11, such as a grease or a hydraulic oil. The pressure medium 11 communicates via a conduit 12 filled with the same pressure medium, with an axial pressurization means, which can consist of a pressure piston 13 with an activation screw, which can be turned with a suitable tool 14, for instance a hexagon key, whereby the pressure medium 11 is pressurized universally, according to well known hydraulic laws. In its turn, this brings the thin walls of the sleeve 8 to expand radially inwards, thereby centering and bracing a tool 15, as shown in Fig. 4. Alternatively, the pressurization means can consist of some external hydraulic pressurization means.

In order to attain optimal precision for the extender with the hydraulic pressurization means, suitably the extender body 6 is machined externally and the sleeve internally after the extender having been prepared and filled with its pressure medium 11, so that the whole extender with its holding sleeve attains an optimally balanced rotation.

The hydraulic holding means effects a very precise centering of the tool and a strong and firm gripping of the tool 15, and since the extender also has an accurately machined outer diameter, the described extender will render a fixation of the tool with extremely small radial runouts - if any at all. To this the advantage is added that the pressure medium has a vibration damping function that improves the cutting machining. Therefore, the machining can be performed with high machining speeds and still accomplish a very high machining precision.

Fig. 4 shows the use of an extender of the

type described in connection with Fig. 3. When using the extender, the tool is first introduced into the sleeve 8 in the extender and with the help of the key 14 the pressure piston 13 is screwed inwards so that the tool is centered and thereafter firmly fixed in the extender. After this, the extender together with the tool is fastened in the chuck 4 of the machine.

Modern tools, such as cemented carbide tools, are often arranged with a central through-going axial conduit 16 for some kind of cooling medium, and for the introduction of a cooling medium into the tool, the tool machine as well as the extender can be formed with some sort of a cooling medium conduit 17 for the passage of a cooling medium through the tool. In Fig. 4, the cooling medium conduit in extender 6 is parallelly displaced to the centrally situated pressure medium conduit 12 and hidden behind the latter. Alternatively, the cooling medium conduit in extender 6 can also be inclined in relation with conduit 12, the only essential factor being that it shall lead from the rear surface of extender 6 to the internal bottom surface of sleeve 8.

After terminated machining, the extender with the tool is detached from the tool machine. The tool can remain in the extender or it can be removed by screwing the pressurization piston 13 outwards, or the tool can be replaced by another tool for continued machininig.

Figures 5 - 7 show an alternative extender which differs from the above described extender mainly in that it is built with a radial collar 18 in which the pressurization piston 13 is arranged in a radially activatable position. This embodiment has the advantage of making it possible to replace tool 15 without

detaching the extender from the tool machine. With this alternative embodiment of the extender, it is possible to arrange the cooling medium conduit 17' along the central axis of the extender. The whole conduit 17', and by the way also conduit 17 in the above embodiment, contains a fitting pipe so that conduit 17' can overbridge the pressure medium gap and the sleeve 8, thus leading into the gap between the bottom surface of hole 7 and the rear end of tool 15. Said pipe has a length corresponding to the whole conduit 17', or only to a part for extending through the pressure medium gap and the bottom wall of sleeve 8.

It is pointed out that the hydraulic bushing part (reference numerals 7, 8 and 11) never overlap with the part of the extender that is introduced into the machine chuck 4.

Although the holding part for the extender in the tool machine above has been shown and described as a circular, cylindrical body, it is obvious that it can have any other shape, e.g., an axially conical form and/or have a polygonal or other cross-sectional form. Moreover, the front part for holding the tool can have an external slightly tapered form in order to further improve the accessability to obstructed working surfaces. Thus, in Fig. 7 the part in front of collar 18 can have a tapering angle of 2 to 4°.

CLAIMS

1. Tool extender for machining machines consisting of an extender body (6) arranged in known way to be braced in, e.g., a chuck (4) in a tool machine and formed with a holding means for a tool (15), c h a r a c t e r i z e d in that the holding means for the tool in the extender is of a hydraulically activatable type and is formed as a sort of hydraulic gripping bushing with an internal thin, unslotted sleeve (8), which is very precisely centerd and fixed and specially welded in an axial hole (7) at the end of the extender, in such a way that a small gap is created between the hole (7) of the extender and the gripping sleeve (8), which gap is filled with a plastic or elastic pressure medium (11) arranged to be pressurized and depressurized, whereby a tool (15) of adjusted dimension is fastened in the extender and detached from the extender by the hole in the gripping sleeve (8) changing its radial dimension.

2. Extender according to claim 1, c h a r a c t e r i z e d in that means (13) for pressurization of the hydraulic pressure medium (11) in the extender are arranged in the shaft of the extender.

3. Extender according to claim 2, c h a r a c t e r i z e d in that the pressurization means (13) are axially arranged on the end of the extender which is inserted into the tool chuck (4).

4. Extender according to claim 2, c h a r a c t e r i z e d in that the extender is formed with an enlarged radial collar (18) and in that

the pressurization means (13) are radially arranged in this collar (18).

5. Extender according to claim 2, 3 or 4, c h a r a c t e r i z e d in that the pressurization means (13) form a pressurization chamber which communicates via a conduit (12; 12') with the pressure medium (11) in the pressure medium gap between the extender body (6) and the sleeve (8).

6. Extender according to any of claims 2 - 5, c h a r a c t e r i z e d in that the means for pressurization of the hydraulic pressure medium (11) consist of a pressure piston (13) which is threaded into the extender body (6, 6') and which creates a pressurization of the pressure medium (11) when screwed inwards and an expansion radially inwards of the internal sleeve (8).

7. Extender according to any of claims 2 - 5, c h a r a c t e r i z e d in that the pressurization means for the hydraulic pressure medium (11) consists of an external pressure medium source.

8. Extender according to any of the preceding claims, c h a r a c t e r i z e d in that it is formed with a conduit (17, 17') for a cooling medium, which conduit leads to the internal bottom surface of sleeve (8) and is arranged to lead a cooling medium through a corresponding cooling medium conduit in the tool.

Fig. 1

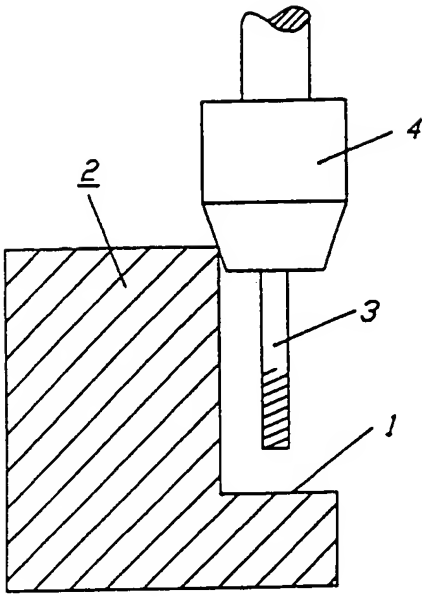
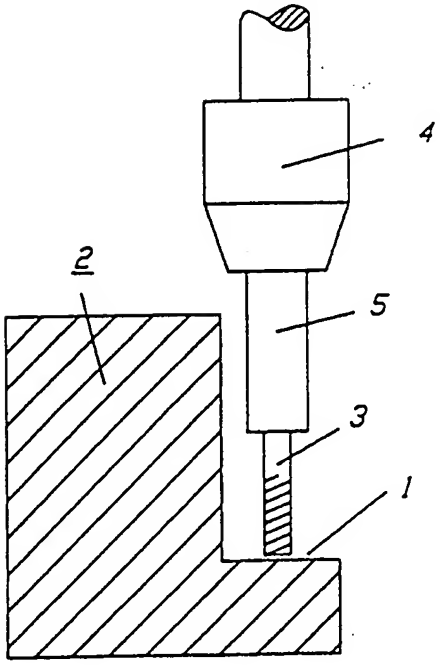


Fig. 2



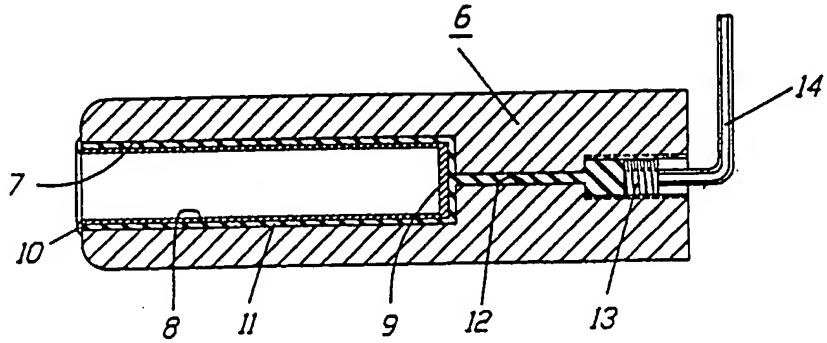
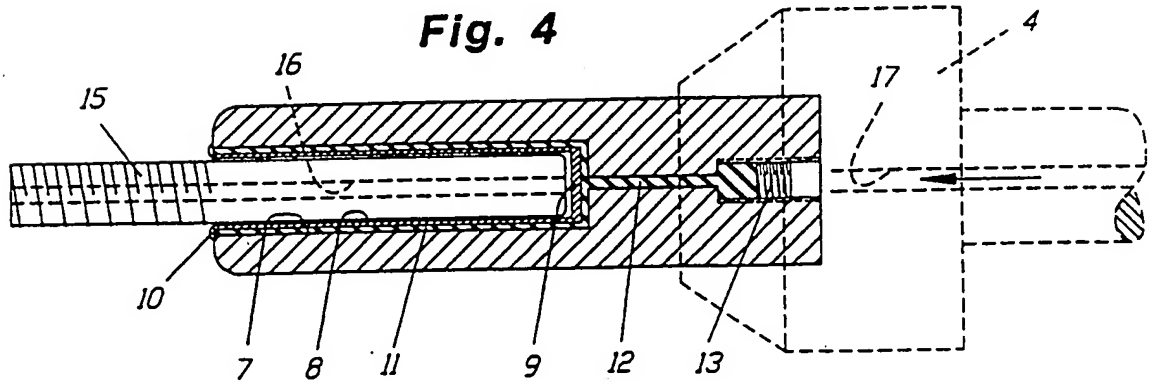


Fig. 3

Fig. 4



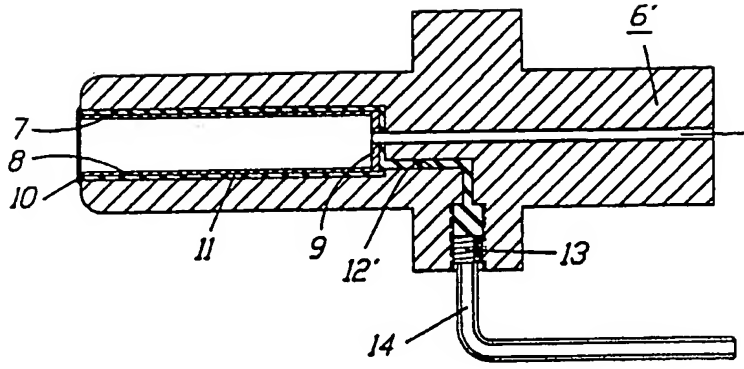


Fig. 5

Fig. 6

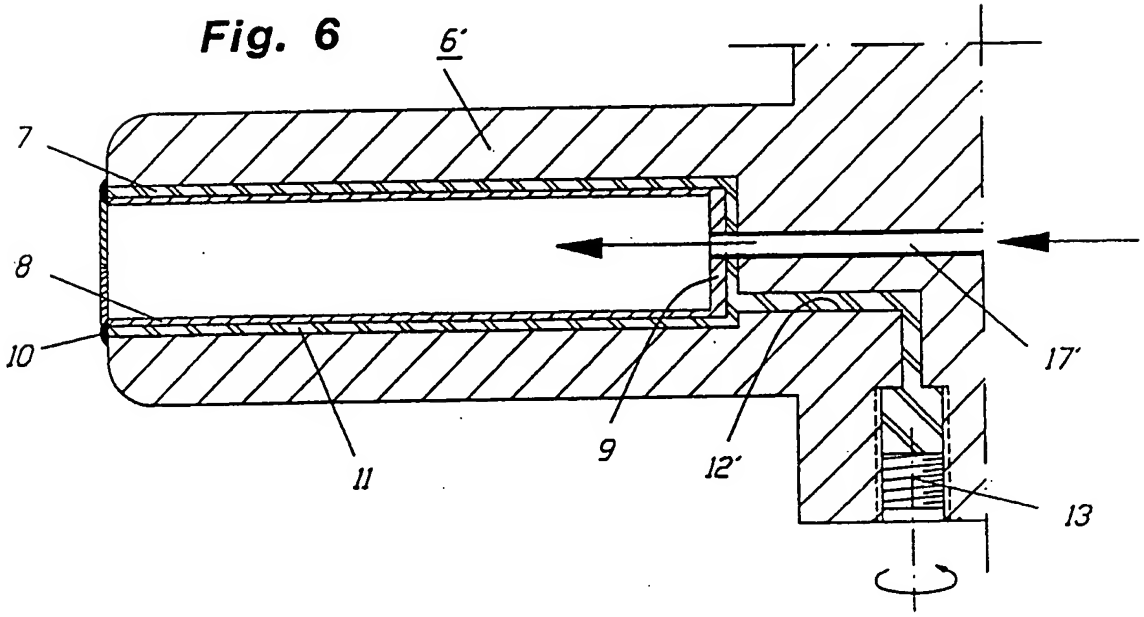
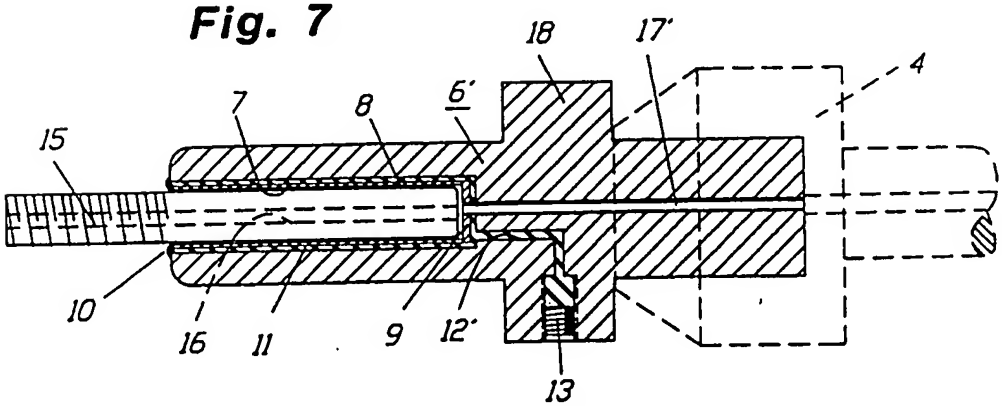


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/00438

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B23B 31/30, B23B 31/40 // B23Q 3/12
According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC5: B23B, B23C, B23Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	US, A, 5067861 (DANIELSEN), 26 November 1991 (26.11.91), column 1, line 45 - column 2, line 23, figure 2	1,2,4-7
A	US, A, 3677559 (ANDRE ET AL), 18 July 1972 (18.07.72), column 1, line 57 - line 64, figures 1-7, claim 1	1-7

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Information on patent family members

02/07/94

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